

A Case Study of Summative Assessment Methods and Feedback in Chemistry

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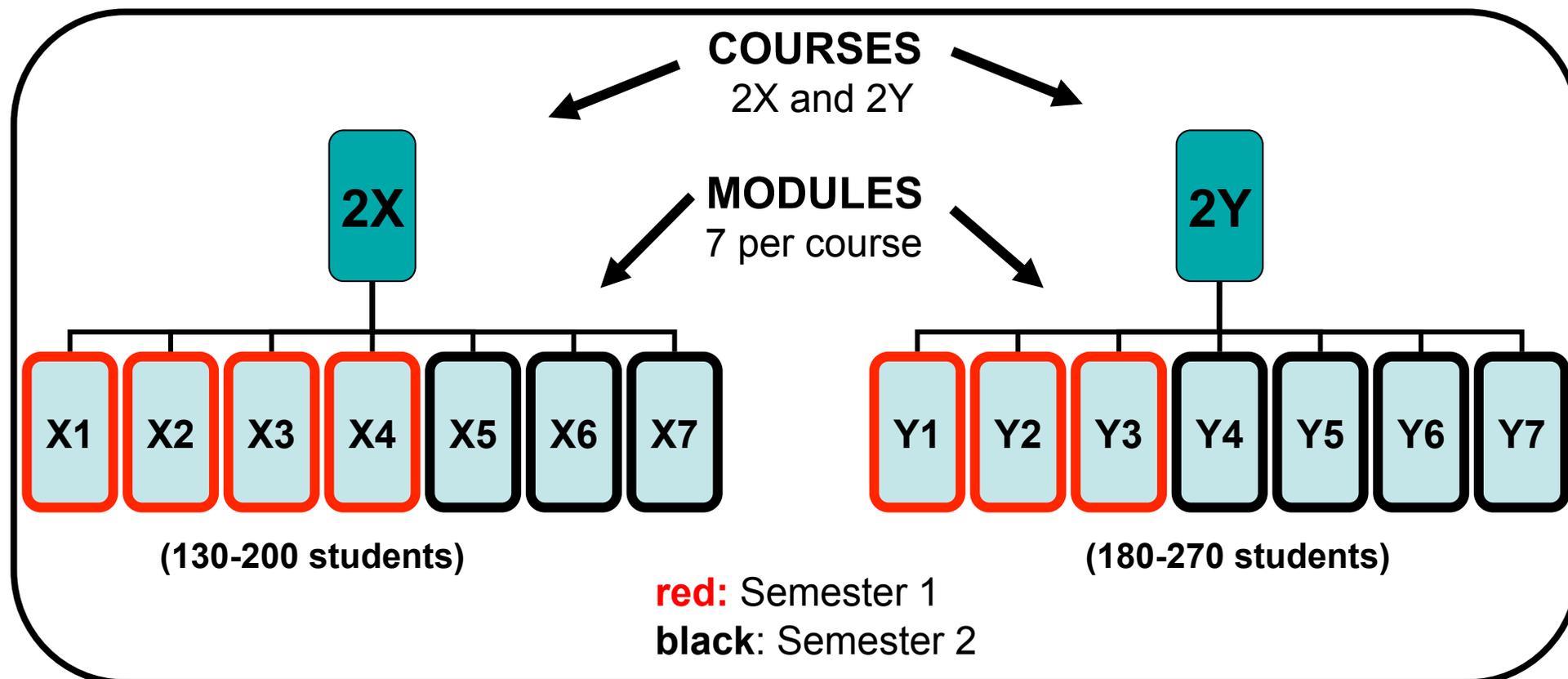
Learning and Teaching Conference (Session 3B)

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Outline

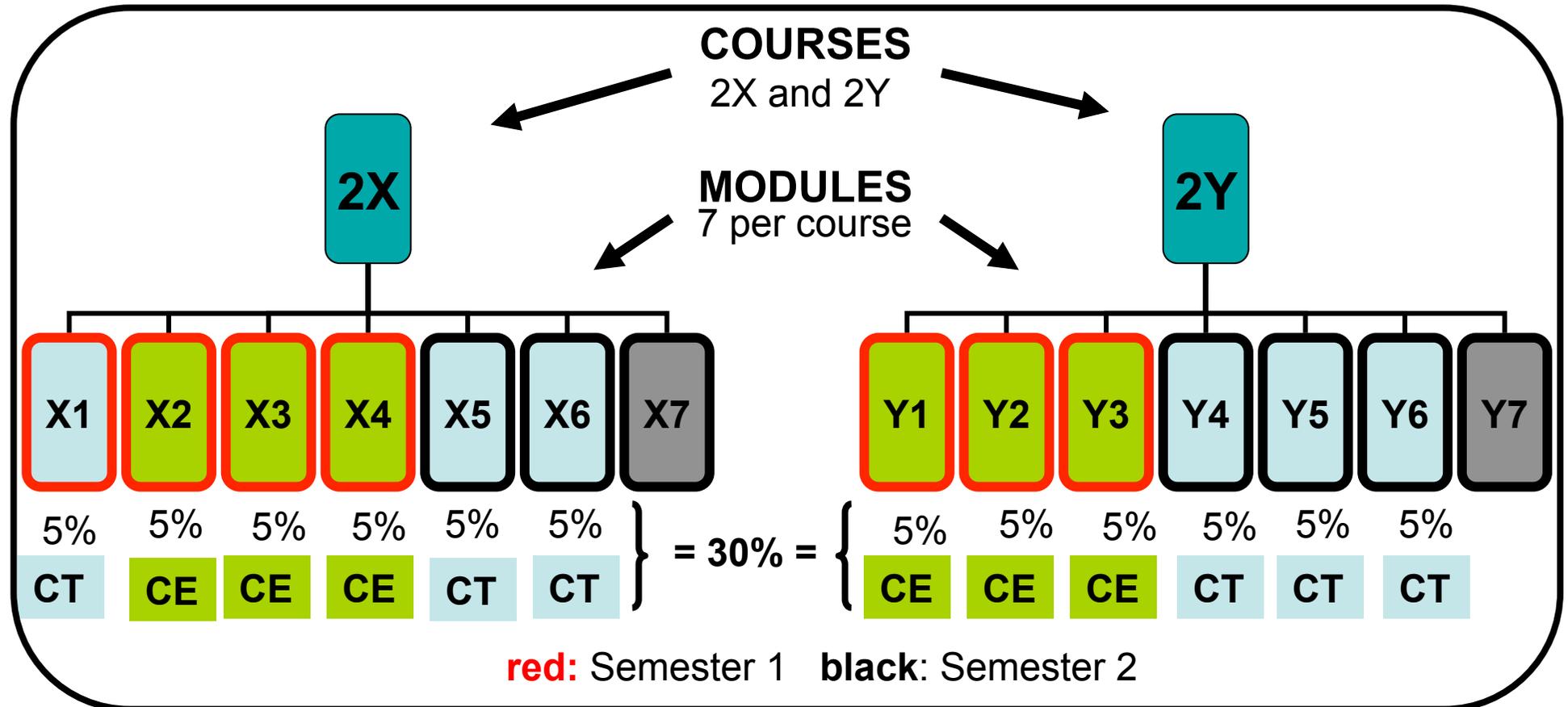
- Case study over FOUR years
- Three different methods for delivering Class Tests (CT) and Class Exams (CE)
 - Paper based CT (**PCT**)
 - Moodle-based CT (**MCT**)
 - Intelligent Character Recognition Format CT (**ICR**)
- Explore:
 - Average results between these 3 methods
 - Impact on final Degree Exam (DE) results
 - Improved learning experience for students
 - Ease and speed of formative FEEDBACK to students
 - Teaching Efficiency for Staff
 - Overall Student satisfaction (feedback, focus groups)
- Review (merits & disadvantages of each approach)
- Discussion
- Developments and Future Plans
- Acknowledgements

Chem-2 Background: Courses & Modules



- **Both courses** (2X & 2Y) run concurrently & interleaved in 11am lecture slot
- Each course has **7 modules**:
- Each MODULE has:
 - A different lecturer
 - 7 lectures
 - one tutorial session
- Timetabling: coordination of lectures, tutorial and continuous assessment

Background: Class Test (CT) & Class Exam (CE)



- Each module has 5% assessment (except final X7&Y7-covered in DE) so each course has 30% CA from CT&CE
- **CE:** in Dec. Exam period and contains 3 modules
- **CT:** are held throughout year and each session covers 2 modules
- Each course (2X/2Y) requires 3 sittings throughout year (total of 6 sittings required to cover all 12 2X&2Y modules)
- **My interest:** appointed class head in 2008 and I lecture one chem-2X module

Paper-based: PCT & PCE (08-09)

- **BACKGROUND:**

- in **08-09**, I assume role of Chem-2 Class Head.
- Run following previous approach (paper-based CT & CE) but **CHANGES** include establishing a **Chem-2 MOODLE** site:
 - for notices and increased feedback for Chem-2 including:
 - Model Answers (MA) for tutorials
 - MA for CT and CE (previously hard copy on noticeboard)

Note: for this year, CT&CE = 35%, Labs = 10%

- **Question Format:** Short Answer Question (SAQ).
- **Marking (Type, Time & Turnaround):**
 - manual, (approx 1 day per lecturer), 1-4 weeks (depending on lecturer).
- **Feedback (Type, Ease & Speed):**
 - Returned marked scripts
 - publication of marks, grades and Q&MA on Moodle
- **Student Satisfaction:**
 - Only comment when a delay in release of marked CT/CE.
 - Selective studying for DE (other courses) and not PCE in December Exam period results in falling behind in chemistry.

Paper-based: PCT & PCE (08-09)

- **Difficulties:**
 - Timetabling with reduced (11) lecture weeks
 - Timing of CT/CE after final lecture and tutorial per module
 - Management of paper scripts for large student numbers
 - Cheating during CT in LT
 - SNS requirements for extra time
 - Students not collecting marked scripts (only a 30% uptake)
 - Turn-over time
- **Benefits:**
 - Short Answer Questions (SAQ) easily prepared
 - High attendance rate
- **Teaching Efficiency for Staff:**
 - Q preparation
 - Invigilation
 - Marking (approx 1 full day)

Moodle-based: **MCT** & Paper-based **PCE** (09-10)

CHANGES for 09-10:

- Increased amount of material on Moodle and level of Feedback (e.g. previous CT/CE and MA)
 - **Use “Quiz” in Moodle for CT (MCT)** for 3 modules per course (ie: total of 15%)
 - Continue using paper-based CE (**PCE**) for 3 modules per course (total of 15%)
 - CT&CE=reduced to 30%, Labs increased to 15%
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- **Question Format:**
 - **MCT** : Multiple Choice Questions (MCQ)
 - **PCE**: Short Answer Questions (SAQ)
 - **Running Tests:**
 - **PCE** : in Exam Halls in December Exam period. Invigilators needed.
 - **MCT** : on-line, remote access, 24 hour window, invigilated by Class Head
 - **Marking (Type, Time & Turnaround):**
 - **PCE** : manual, as before, (1-3 weeks)
 - **MCT** : automatic, (24 hours), 1 day turn-around.
 - **Feedback (Type, Ease & Speed):**
 - **PCE** : as before.
 - **MCT** : Feedback consists of marks, grades, Q&MA published on Moodle. The actual choices made for each MCQ were also published.

Moodle-based: **MCT** & Paper-based **PCE** (09-10)

Student Satisfaction: Mixed passionate responses from both camps.

Pro- MCT :

- less stress,
- better marks.
- Liked flexibility of doing from home at own time-scale.

Cons- MCT :

- perception that fewer marks awarded (despite contrary being true)
- stress of hardware/software issues arising
- timer off-putting
- no chance to review before submission.

Comments:

- Less motivation of study for **MCT** than a **PCT**.
- Motivation to engage with **MCT** higher than **PCT** but more motivation to study for a **PCT** than a **MCT**.
- Most students prefer feedback of **PCT** as opposed to quicker **MCT** response. However, only 30% collected PCT (generally, the stronger students).
- Stronger students preferred traditional **PCT** approach

Moodle-based: **MCT** & Paper-based **PCE** (09-10)

Difficulties:

- **MCQ**: formatting of questions
- **Moodle QUIZ**: learn software (and incorporate chemical figures)
- **Invigilation**: **MCT** open for 24 hours on scheduled day, Class Head invigilates
- **Timing**: once **MCT** accessed, each script timed for 20 minutes
- **Training students & testing home computers**:
 - Trial **MCT** prepared to let students test system and become familiar with format.
- **Security Controls**:
 - password protected
 - Screen locked
 - One attempt only
 - each CT module had 4 discrete versions
 - Questions & Answers randomised
 - MCQ answers:
 - 6-7 possible answers for each Q, including “none of the above”.
 - Scaled MCQ Answers: 100%, 75%, 50%, 25% and several 0%. This allows for **partial credit** to mimic **PCT/SAQ** marking.
- Moodle spreadsheet: provides student number linked to first name.

Moodle-based: **MCT** & Paper-based **PCE** (09-10)

Benefits **MCT** :

- Flexibility (resits, SNS)
- SNS extra time,
- No paper scripts to print, manage and return.
- No room booking

MCT Teaching Efficiency for Staff:

- MCQ preparation (4 closely related versions of a CT script for each module)
- effort to learn how to design and write MCQ
- no invigilation
- no marking

Class Head (CH) MCT :

- Increased work for Class Head

Intelligent Character Recognition (**ICR**) CT (10-11)

CHANGES for 10-11:

- **3 new modules** (2 in 2X and 1 in 2Y) and reordering of several modules.
 - **No CE**, all CT. (Nothing in December Exam period)
 - **CT with ICR format:**
 - Lecture Theatre (LT) and Exam Halls (when available)
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- **Question Format:**
 - Multiple Choice Questions (MCQ) and Short Answer Questions (SAQ)
 - **Running CT:**
 - Lecture Theatre: 10 versions of each script prepared with randomised Q&A
 - Exam Halls: only one version needed
 - Invigilators needed
 - **Marking:**
 - All MCQ-automatic,
 - If SAQ, first manual marking, then scanned marks added to spreadsheet .
 - Scanning & Marking generates a spreadsheet with all details.

Intelligent Character Recognition (ICR) CT (10-11)

Feedback (Ease & Speed):

- post **ICR CT** with MA and additional feedback on Moodle,
- post charts of average response per question, average mark and average grade distribution per module on moodle
- Time-dependent on manual marking of SAQ and on availability of specialist technician (turnaround: 3 days to 2 weeks).

Student Satisfaction:

- Happy with turn-around time for feedback
- Like additional detailed feedback
- Very happy that there are NO Chem-2 CEs in December Exam period

Difficulties:

- design CT in new format
- new software system

Benefits:

- Accurate spreadsheet and data produced without additional steps needed.
- Students happy with feedback as provided on Moodle.

Teaching Efficiency for Staff:

- Q preparation,
- Invigilation (sometimes),
- no marking (except for SAQ).

Class Head (CH):

- Increased work-load

ICR CT (& Emailer Feedback)(11-12)

CHANGES for 11-12:

- CT reorganised to contain either 2X or 2Y modules only in the one sitting.
- Only Exam Halls used
- FEEDBACK to students using **EMAILER software**

Feedback (Ease & Speed):

- **Emailer**- individually email marks, grades and scanned scripts to student.

Student Satisfaction:

- Happy with turn-around time for feedback
- Love personal feedback by email
- Still very happy that no CE in December Exam period
- Like Exam Hall environment to help acclimatise to Degree Exams

Difficulties:

- Learn to use new software
- one hiccup with mismatched front and back script, corrected

Benefits:

- No paper handling after scripts are scanned.

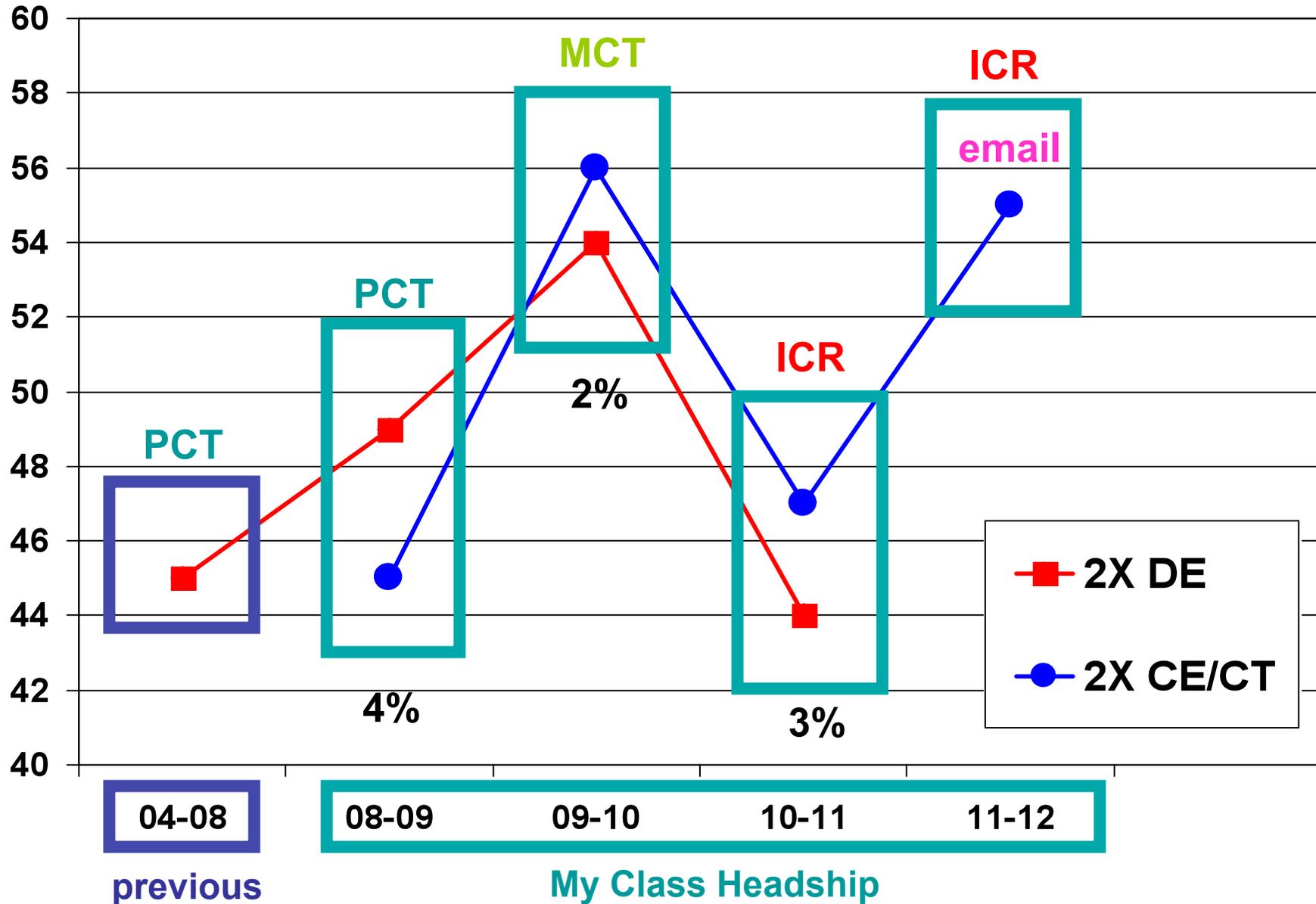
2X & 2Y Comparison of CT/CE with DE and Pass

(average)	PCE/PCT previous	PCE/PCT Start of my CH		PCE/MCT	ICR CT	ICR CT & EMAIL F/B
2X	04-07	08-09		09-10	10-11	11-12
Pass (%)	62	65		78	68	-
DE (%)	45	49		54	44	-
CT/CE (%)	-	45		56	47	55
		PCE: 33	PCT: 58	PCE: 44	MCT: 69	
2Y	04-07	08-09		09-10	10-11	11-12
Pass (%)	64	76		85	79	-
DE (%)	51	54		56	54	-
CT/CE (%)	-	49		69	53	54
		PCE: 51	PCT: 46	PCE: 67	MCT: 70	

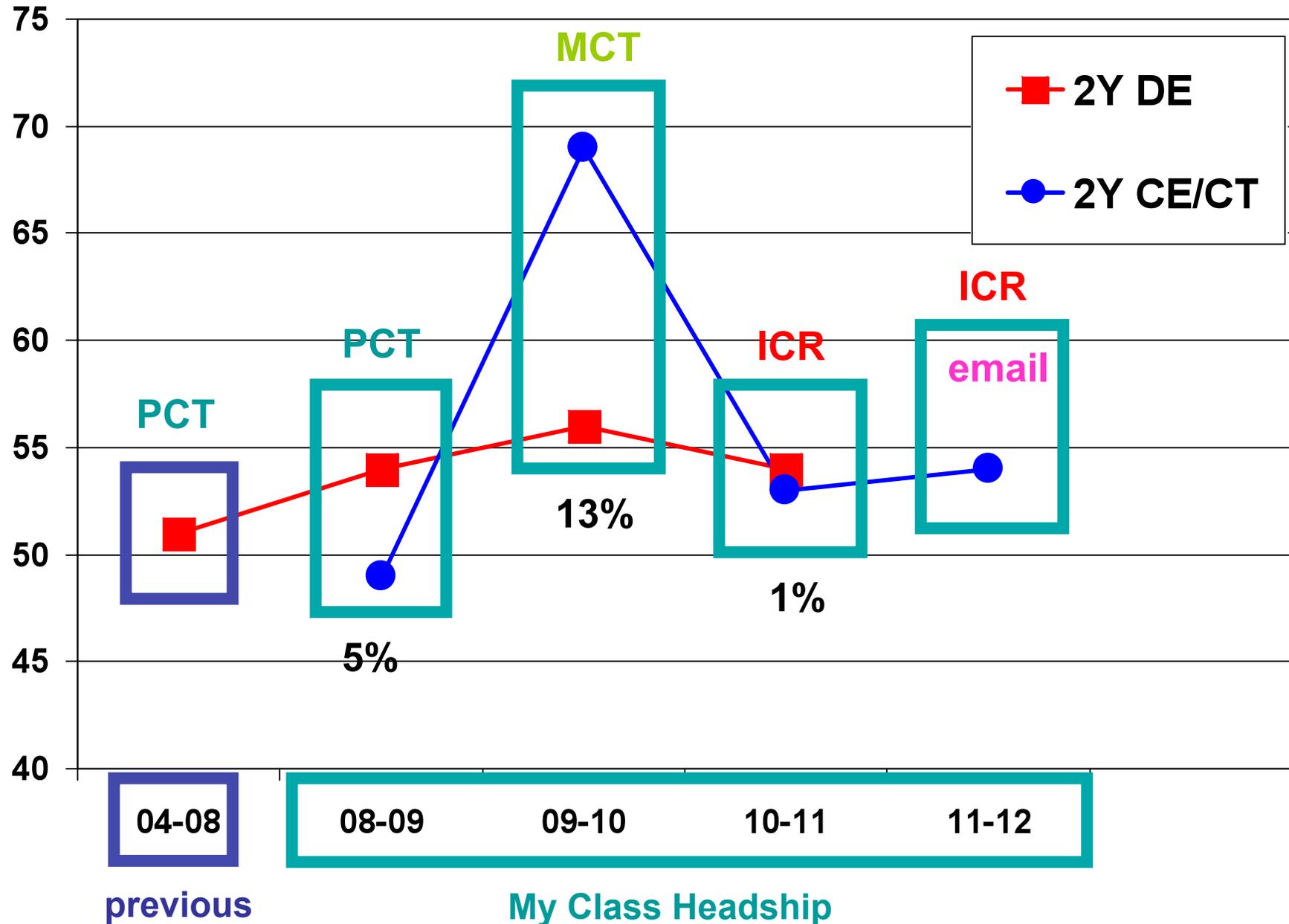
PCE- Paper Class Exam
PCT- Paper Class Test
MCT- Moodle Class Test

ICR CT- Intelligent Character Recognition Class Test
Emailer: Feedback system

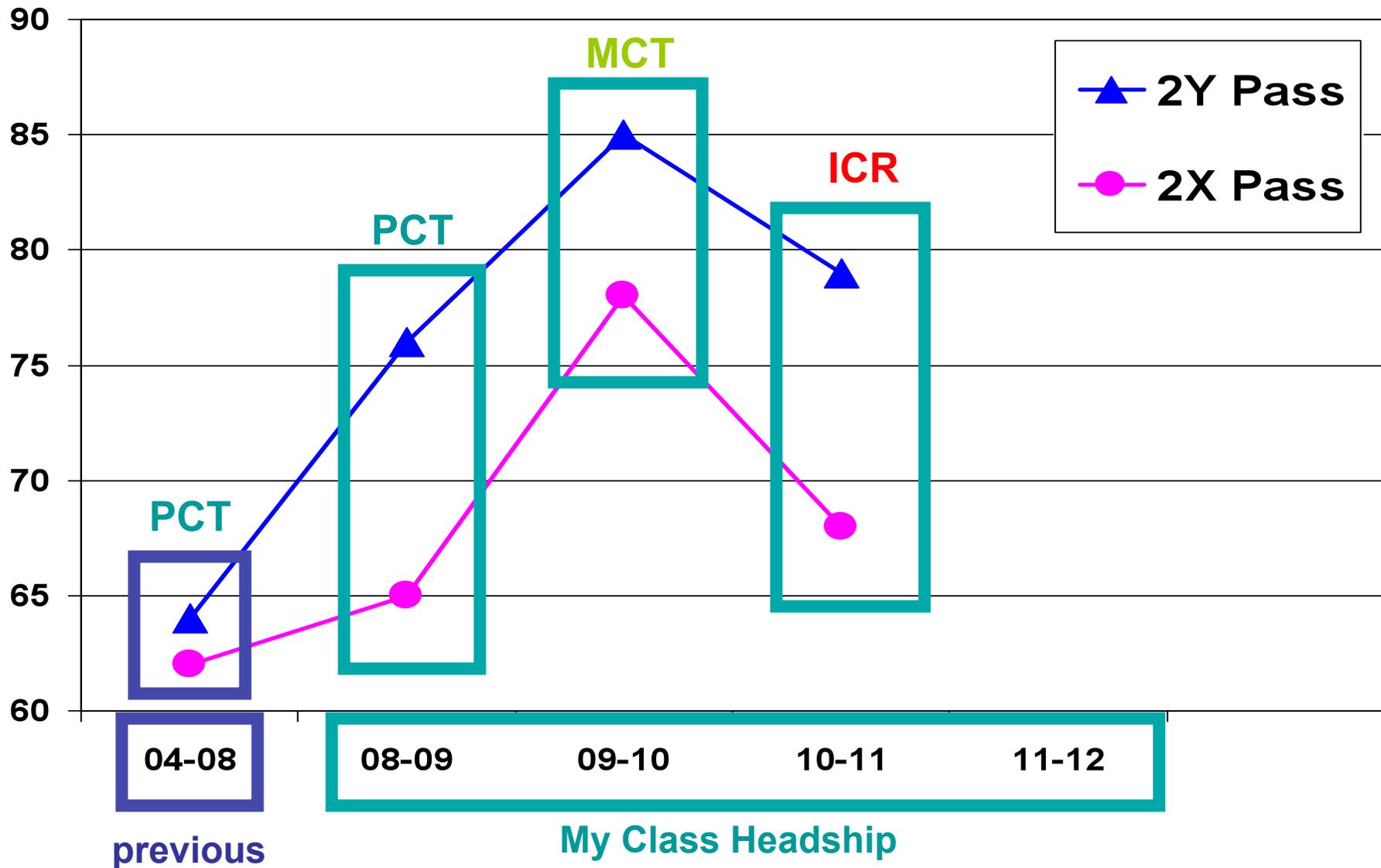
2X: Class Test / Class Exam vs Degree Exam



2Y: Class Test / Class Exam vs Degree Exam



Comparison of 2X & 2Y Pass Rates (%)



Discussion

MCT and **ICR CT** reduce staff workload w.r.t. **PCT/PCE** and enhances ease and speed of formative feedback (Class Head assumes increased workload to facilitate this).

PCT allows for easy SAQ preparation and encourages greater participation but is a clumsy labour-intensive process.

MCT is paper-free and offers flexibility of location and time however, potential for cheating and students not as motivated to study.

Merits of **PCT** superceded by **ICR CT** as both can easily accommodate Short Question Format while **ICR CT** incorporates MCQ format as well as providing e-feedback via emailer programme.

Overall, **ICR CT** offers most complete feedback (and feedback is paper-free), motivates study.

Analysis shows that both **MCT** and **ICR CT** are not detrimental to performance in DE. Improved learning experience for students as demonstrated by enhanced DE and pass rates. Questionnaires and focus groups confirm student satisfaction with developments in CTs and Feedback methods.

Due to changes introduced (enhanced feedback and support) since 2008:

- Average **DE** marks have improved :
 - **2X**: 45% (04-07, average) to 49% (08-11, average)
 - **2Y**: 51% (04-07, average) to 55% (08-11, average)
- Average **Pass rates** have improved:
 - **2X**: 62% (04-07, average) to 70% (08-11, average)
 - **2Y**: 64% (04-07, average) to 80% (08-11, average)

Analysis shows that CT/CE results are good predictor for DE results.

Future Work

- Continue with **ICR CT** & **Emailer** feedback
- Keep multiple CT throughout year but no CE in December period.
- Compare DE results and Pass rate with CT results this year (**ICR CT** & **Emailer** feedback)
- Adapt **MCT** for practice on Moodle as a source of formative assessment.
- Possibly set up **MCT** for emergency cover (snow, resits)

Acknowledgements

- **ICR Specialists:**
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